National Institute of Environmental Health Sciences

Mapping heatwave health risk at the community level for public health action

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Abstract:

BACKGROUND: Climate change poses unprecedented challenges, ranging from global and local policy challenges to personal and social action. Heat-related deaths are largely preventable, but interventions for the most vulnerable populations need improvement. Therefore, the prior identification of high risk areas at the community level is required to better inform planning and prevention. We aimed to demonstrate a simple and flexible conceptual framework relying upon satellite thermal data and other digital data with the goal of easily reproducing this framework in a variety of urban configurations. RESULTS: The study area encompasses Rennes, a medium-sized French city. A Landsat ETM + image (60 m resolution) acquired during a localized heatwave (June 2001) was used to estimate land surface temperature (LST) and derive a hazard index. A land-use regression model was performed to predict the LST. Vulnerability was assessed through census data describing four dimensions (socio-economic status, extreme age, population density and building obsolescence). Then, hazard and vulnerability indices were combined to deliver a heatwave health risk index. The LST patterns were quite heterogeneous, reflecting the land cover mosaic inside the city boundary, with hotspots of elevated temperature mainly observed in the city center. A spatial error regression model was highly predictive of the spatial variation in the LST (R(2) Euro Surveillance (Bulletin Europeen Sur Les Maladies Transmissibles; European Communicable Disease Bulletin) 0.87) and was parsimonious. Three land cover descriptors (NDVI, vegetation and water fractions) were negatively linked with the LST. A sensitivity analysis (based on an image acquired on July 2000) yielded similar results. Southern areas exhibited the most vulnerability, although some pockets of higher vulnerability were observed northeast and west of the city. The heatwave health risk map showed evidence of infra-city spatial clustering, with the highest risks observed in a north-south central band. Another sensitivity analysis gave a very high correlation between 2000 and 2001 risk indices (r Euro Surveillance (Bulletin Europeen Sur Les Maladies Transmissibles; European Communicable Disease Bulletin) 0.98, p < 10(-)(1)(2)). CONCLUSIONS: Building on previous work, we developed a reproducible method that can provide guidance for local planners in developing more efficient climate impact adaptations. We recommend, however, using the health risk index together with hazard and vulnerability indices to implement tailored programs because exposure to heat and vulnerability do not require the same prevention strategies.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3517403

Resource Description

Early Warning System: ☑

resource focus on systems used to warn populations of high temperatures, extreme weather, or other elements of climate change to prevent harm to health

A focus of content

Exposure : ☑

weather or climate related pathway by which climate change affects health

Temperature

Temperature: Extreme Heat

Geographic Feature: ☑

resource focuses on specific type of geography

Urban

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : France

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Intervention: ☑

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Methodology

Population of Concern: A focus of content

Population of Concern: ☑

populations at particular risk or vulnerability to climate change impacts

Children, Elderly, Low Socioeconomic Status

Resource Type: ☑

format or standard characteristic of resource

Research Article, Research Article

Timescale: ☑

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content